(SME) Market Development Project
(ASME)

AGRIBUSINESS COOL CHAIN DEVELOPMENT ISSUES IN ARMENIA

AN EXPLORATORY STUDY AND EVALUATION

Prepared for: Development Alternatives, Inc. (DAI)
Armenia Agribusiness SME Market
Development Project
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1. Executive Summary

This STTA assignment was conducted to explore and evaluate the cool chain issues within the Armenian Agribusiness community.

The background of the reasoning and need for such an assignment is stated in Section 2 of this report.

The process and objectives are further outlined in sections 3 and 4.

In the process of analyzing a specific element of any segment of a countries economics, that plays such a major role as does agribusiness in Armenia, which currently comprises about 30% of the overall economy, it is important to consider all factors that comprise that sector.

Agricultural based products can generally be put into two categories; the first would be for personal and local domestic consumption. The second category would be for distance domestic and export consumption.

The first category rarely requires much, if any, cold chain involvement except to sometimes be stored in a individual household refrigerator for several days. The second category is a completely different matter. The greater the distance from the harvest point to the actual point of consumption the greater the importance of the cold chain.

For the purpose of this study and evaluation the report will be confined to the second category. Fruits, vegetables and flowers are living organisms that undergo all the physiological and pathological processes associated with plants. Because they deteriorate continuously after picking, slowing deterioration processes allows adequate time for successful marketing.

Most causes of deterioration operate more rapidly at high product temperatures. Understanding the relationship of temperature management to causes and effects of deterioration is essential to properly protecting the products.

With regard to the cold chain issues and the importance to the quality and market value of products produced by the agribusiness community, the growers, cold store facility operators and business

related providers such as transport companies are in need of assistance and most importantly, education.

Many of the problems in the agribusiness are directly linked to the lack of understanding of the importance of the use of a cold chain to maintain the quality and shelf life of the products.

Produce temperature management must begin from the instant of harvest when post harvest deterioration begins. With highly perishable products, a few hours delay before starting cooling can cause damage that cannot be overcome by subsequent good handling practices.

Because the market life of produce is affected by time and temperature, produce should be kept as cold as possible without causing damage. Deterioration level is directly related to the length of exposure to higher temperatures regardless of when exposure occurs. Therefore, effective protection of produce requires quick cooling and good temperature maintenance throughout distribution.

There are of course many things that growers, transporters and other business related providers can do to learn and educate themselves to achieve a better cold chain process. Also certain activities could be done by DAI to help the local agribusiness and related providers help themselves.

Some of these activities are outlined in this report under sections six and seven, Findings and Conclusions or Recommendations.

2. Background

The Armenian Agribusiness SME Market Development Project (DAI-ASME) is providing integrated technical assistance to the Armenian Agribusiness community and to specific agribusiness firms that will allow them to seize market opportunities and increase their domestic and export sales on a continuing basis. DAI-ASME identifies markets where existing and new agribusiness products can be sold and develops strategies by which Armenian companies can take

advantage of these opportunities. In addition, ASME provides assistance to strengthen firms that provide support and services to the Agribusiness community.

Armenian Agribusiness produce some high-quality products but the opportunity to increase sales of Armenian grown products, both in domestic and export markets and the ability to provide better quality products to the consumer and reduce losses will not improve at an accelerated rate until several things happen.

First of course a expanded marketing program that encompasses both the domestic and export markets will need to be put in place and secondly the improvement in overall product handling, packaging refrigeration, transportation and distribution will need to occur.

“Cold Chain” is a term encompassing the critical steps and processes that food and other perishable products must pass through to ensure they reach the end-user in a safe and high quality condition. Implementation of a well designed and managed cold chain is critical to achieving that end.

In Armenia, cold chain problems exist for almost all commodities and across multiple sectors beginning at the farm and continuing through domestic collection, processing, storage and handling facilities for international transport. It is problematic at both the wholesale and retail levels. Lack of, or limitations to the cold chain system, namely in refrigeration and/or freezing, improper handling and storage procedures, and/or inadequate humidity control, ultimately raise serious issues for Armenian Agribusiness. Every year, virtually millions of dollars in domestic and export income is lost due to product spoilage and damage losses.

3. The Process

Through a combination of electronic and on-site investigation of selected DAI-ASME clients, the process is to:

- Identify key links in a well-developed cold chain for agricultural products.
- Identify and analyze features of the cold chain, as they exist today throughout Armenia.

- Identify specific components in the cold chain from harvest to retail sale in 3 key sectors; frozen fruits and vegetables, fresh and frozen fish, and fresh market flowers.
- Determine "overlapping or shared" technical factors (common to the 3 key sectors) that if coordinated, would enable shared improvements to be identified and new technology to be introduced in a comprehensive manner.
- Present recommendations (technological, commercial or environmental) to strengthen the cold chain with the 3 key sectors.

4. The Objectives:

The principal objective for this project is to provide assistance to Armenian Agribusiness that will potentially benefit many commodities, including fresh and frozen fruits and vegetables, processed meats, poultry, seafood, dairy products and cut flowers, which are grown and/or processed in Armenia. Development of a fully functional cold chain will specifically benefit value-added and export-oriented products, an area where substantial growth can be achieved in the foreseeable future.

This report will define:

- Key links in a well-developed cold chain, based on international expectations.
- Features of the cold chain, as they exist today throughout Armenia.
- Results of overall findings, fundamental cold chain weaknesses and opportunities within the 3 key sectors noted.
- Practical recommendations to strengthen cold chains within the 3 key sectors.
- Create a detailed report defining the items listed above.

5. Activities:

Between November 14th and November 23rd, the following activities took place.

1. A briefing from DAI as to the cold chain issues as they saw them, as well as a review of existing cold chain survey

report and general discussions regarding timetable and scheduling for site visits.

2. Visits to several local street markets to evaluate the types and conditions of products available and method of preservation.

3. Visit larger “Super-Market” type store to evaluate the types and condition of products available and methods of preservation.

4. Visit to Tamara Fruit, located in the village of Carby, outside of Yerevan. During the visit we met with the manager and toured the facility, answered questions and made suggestions. See detailed account under “Individual Clients Reports”.

5. Visit to Gold LLC, located in the village of Margara, outside of Yerevan to evaluate existing facility for cold storage. See detailed account under “Individual Clients Reports”.

6. Visit to Zvartnots Cargo Center, located at Zvartnots International Airport at Yerevan to evaluate existing facility and discuss future cold storage needs for import and export needs by air to and from Armenia, see detailed report in “Individual Clients Reports”.

7. Visit to Yerevan’s large open/housed marked complex to evaluate the types of products and conditions of products and methods of preservation.

8. Visit to Gyumri Refrigerated Warehouse, located in town of Gyumri to evaluate the facility and its potential uses, see detailed report in “Individual Clients Reports”.

9. Visit to “Republic Association of Potato Growers”, located just outside town of Gyumri to evaluate the facility and its potential uses, see detailed report in “Individual Clients Reports”.

10. Visit to Gamma, located at the outskirts of Yerevan to evaluate the facility and make suggestions for two

refrigeration systems, see detailed report in “Individual Clients Reports”.

11. Visit to Apaven Freight Forwarding, located in Yerevan, to learn what part they might play in the overall transportation of perishable fruits, vegetables and cut-flowers, see detailed report in “Individual Clients Reports”.

12. Visit to Bariq-P Refrigeration Facility, located in the village J. Margava, Armavir Marz region, to evaluate their existing older refrigeration facility and answer owners questions, see detailed report in “Individual Clients Reports.

13. Visit to CMN International S.A., located in Yerevan, to discuss their views of the trucking and ocean transportation situation for agri products.

14. Visit to Meltrans, located in Yerevan to discuss their views of the trucking and ocean container transportation situation for agri products.

15. Visit to Geghard Slaughterhouse, located in Berd to view and evaluate the overall facility and evaluate the refrigeration system.

16. Visit to Ushi Agro, located in village Ushi outside Yerevan to view a small conversion of an existing building into two cold storage rooms for apples.

17. Visit to Zvartnots International Airport, located at airport in Yerevan, to have discussions with Ana Cristina Scherinian C.E.O. about the cold/freezer capacity at the existing cargo center.

6. Findings & Conclusions:

Individual Consultations

The thirteen individual one on one consultations that were conducted with the different clients were held at their facilities to evaluate their operations and how those operations might fit within the overall cold chain operations in Armenia.

It became evident quite early on that the cold chain availability within Armenia was quite limited. All but one of the facilities visited had no provisions for high humidity storage conditions.

There was little understanding with the owners and operators of the facilities of the importance of humidity in the cold chain operations.

In the areas of frozen fruits and vegetables and seafood and meats all in the frozen state, humidity plays a much less important role.

In the field of fresh fruits and vegetables and cut flowers a high humidity atmosphere around the products at all levels of the cold chain are very important.

Domestic Market

In almost all cases during the visitations it was established that the facilities had little or no demand for the use of the facilities for cold storage purposes. Much of the domestic market is handled in the same manner as many other developing nations, that is the product is harvested and sent directly to the open air type market places and assuming that the product is sold in 1 or 2 days after harvesting this system will continue to work to meet the demands of the domestic market until such time that more “supermarket” type stores are available to the domestic consumers.

Export Market

Several of the clients, primarily transportation companies had attempted to export such commodities as fresh apricots with varying degrees of success or failure.

The failure was due primarily to an incomplete cold chain with much of the damage being done between the time of harvest and the product cooling cycle.

Exporting has the potential of becoming a much larger area but for this to happen several things must occur:

1. There must be markets established which will accept the exports at a price level which allows proper handling of the product between harvest and delivery to occur.
2. The grower, shipper and transportation company all must understand the importance of a continuous cold chain if successful exporting is to be achieved.

3. Exporting market areas will need to be developed on a organized scale.

4. A quality standard procedure will need to be adopted by the grower to insure that only the best quality products are being exported, as the competition in exporting is quite high.

DAI-ASME Participation

I did not find any strongly organized grower groups so I think the role of DAI-ASME could be to continue to promote the importance of the cold chain and voluntary quality of the products offered.

7. Recommendations:

Specific recommendations were made to each client at the time of the visitation to each one of their facilities, their questions answered and or literature left with them. Specific recommendations are as follows:

- Particularly for exporting purposes a minimum quality standard shall be set, voluntarily by the growers and rigidly adhered to so that the quality of product coming out of Armenia is recognized as a premium product.
- Improving the packaging of the products especially for export. Also consider standard packaging for domestic products and in both cases take into account the cold chain need for package venting.
- With the adoption of a quality standard consider, in time, the use of a grown in Armenia seal but only after a continuous supply of quality product is assured.
- Hold a series of seminars for agricultural groups, growers, federations and shippers groups with information covering

the importance of the cold chain as it affects their area of operations.

- Consider forming an association of exporters that can work with the different elements of the quality assurance association of growers, transportation providers and agricultural associations.
- Produce a list of facilities that could be used commercially or leased by growers for the precooling and or storage of fresh or frozen products or fresh cut flowers and list the capability of each facility.
- Promote the formation of a cold storage operation association and provide seminars for the education of the owners of such facilities to better understand the facilities needed for such storage uses.
- Consider cooperative exporting under one label, properly quality graded, precooled, stored and transported.
- Design and hold seminars for cut flower growers to educate them in the importance of temperature, humidity and packaging to compete in the world market.

Many of the items mentioned above are essential to a quality domestic and especially an export market and from what I was able to be exposed to during my visit I would suggest much of the lead would have to come from an organization such as the DAI-ASME organization.

In successful agricultural growing countries, both developing and developed, the elements mentioned above are all in place and strictly adhered to, to make those operations successful.

Having “Cold Storage Facilities” which are not fully functional or lack proper humidity, temperature control, rapid cooling potential or proper conditions for long term storage do not translate into having a cold chain. It takes a well-defined, well-managed program to compete in today’s worldwide market.

8. List of Individual Client Consultations:

Tamara Fruit
Gold LLC
Zvartnots Cargo Center
Gyumri Refrigerated Warehouse

Republic Association of Potato Growers
Gamma
Apaven Freight Forwarders
Bariq-P Refrigeration Facility
CMN International S.A.
Meltrans
Geghard Slaughterhouse
Ushi Agro
Zvartnots International Airport

9. Individual Clients Reports:

1. Tamara Fruit
2. Gold LLC
3. Zvartnots Cargo Center
4. Gyumri Refrigerated Warehouse
5. Republic Association of Potato Growers
6. Gamma
7. Apaven Freight Forwarding
8. Bariq-P Refrigeration Facility
9. CMN International S.A.
10. Meltrans
11. Geghard Slaughterhouse
12. Ushi Agro
13. Zvartnots International Airport

1. TAMARA FRUIT

Thursday, November 14, 2002

Visit to Tamara Fruit – with Armen Matosyan

- I was told that Tamara Fruit is a private company.
- The parent company is an ice cream company (one of the larger ones in Armenia).
- Tamara Fruit processes a number of items including:

    - Frozen mixed vegetables
    - Frozen mixed berries
    - Bottled fruit juices
    - Store a small amount of items such as sweet peppers and eggplant in a frozen state for packaging

and selling in the winter months when they are not available, the items are repackaged in small packages and sold as frozen vegetables.

Observations:

- Sanitary conditions were quite good at this facility.
- A program was in place to clean the facility on a scheduled basis.
- The facility has a laboratory in house.
- Personal hygiene needs, i.e. restrooms, hand sinks, soap, hand towels, etc. were readily available.
- Manager stated that they have in house staff to maintain equipment.

2. GOLD LLC (COLD STORAGE)

George Baghumyan
Friday, November 15, 2002
Visit to Gold LLC (Cold Storage)

Went with Armen Matosyan and Grisha Shirvanyan.

- Mr. Baghumyan operates a number of businesses including: cattle growing, almond growing, chicken growing, cold storage plant, all according to him!
- The purpose of the visit according to Armen was to see if there was some use of the cold storage facility in connection with other projects.
- The facility we visited was approximately 20^{M} x 72^{M} (65'-8" x 236'-3") 15,512 sq. ft. 1440 ^{M2}.

Refrigeration Equipment:

The refrigeration equipment in room 1 and 3 (R-22) appear to be the same size and I was told was from German technical. The equipment in room 2 (R-717) I was told was from Russia.

The R-22 equipment is outside, but housed in a weather protected structure. It appears to all be in working order, there were no signs of disabled equipment, the owner states that everything is working and only needs to be started up.

Room 2 has been converted into a freezer room or rooms. There has been a concrete floor put in at mid-point making the ceiling height of each story about 3M+. The conversion is not completed. Coils were in place in each of the newly formed smaller rooms, but there were signs of some small pipe repairs going on. The floor finishes and wall protection were yet to be completed.

The original R-22 equipment for Room 2 has been taken out, the weather protection housing removed and all parts stacked at the end of the building. The R-717 equipment, which consists of piston type compressor that I was told by the owner were Russian made?

There was no housing over or around the equipment to form a machine room; the equipment was exposed to the weather. The owner stated that they were going to construct a building around the equipment.

The owner stated that the ammonia system was ready to operate but it appeared to me that there were several things yet to be done prior to the R-717 equipment being ready to be put into operation.

Room 2, because of the conversion, does not lend itself well for fruit or vegetable storage and should not be considered for that purpose.

Observations:

Overall, Rooms 1 & 3 could be used for the storage of fresh fruits or vegetables assuming that the refrigeration capacity is okay and the equipment is in good working order. The owner indicated that each room would hold 1000 tons of product.

(Exercise) = 79' x 46' = 3,634 sq. ft.,
3634 sq. ft. ÷ 16 sq. ft. = 227 spaces
227 x 1800# = 408,600# ÷ U.S. 2000 # Met. 2204#
= 185M Tons
1000 M. Tons ÷ 185 = 5.4 levels

Assume that the entire floor area was used, the floor area would equal 227 spaces, if each space weight equals 1800# then the floor space would equal 185M tons, if stacked 6 "pallets" high,

then the total metric tons would equal 1110 metric tons. Observation it would appear that the stated capacity was stated a bit high?

The construction of the overall facility is good, using a galvanized pre-fabricated structural frame concept and pre-fabricated insulated panel construction method with concrete floors. I was told the technology was German also? The access to the facility and up to the front door of the facility appears to be all year approach.

The overall appearance of the facility is good except for the items already mentioned above.

There was no stand by power source, so if power outage is of concern then there may be a Gen-Set needed.

Owner stated that they have staff or outside person to start up equipment and monitor it 24 hrs. per day when equipment is running.

3. AIR CARGO FACILITY

Friday, November 15, 2002
Zvartnots International Airport
Zvartnots Cargo Center
Dr. Karen Mkhitarian

Visit to Zvartnots Cargo Center with Fred Harris, Armen Matosyan, Grisha Shrivanan

Reason for visit: To look at possible cold storage room addition.

Existing Facility: The existing facility was constructed in 1993 by an American company. The layout and construction are very good! The level of detail is excellent!

The construction is of pre-engineered metal building type with great detail to all aspects of usage.

Discussions: Discussions covered many aspects of the overall operations of facility, including such items as customs

operations, customer usage, equipment availability, staff levels, services provided, future needs for cold and freezer storage capacity.

Photos and measurements of facility taken and a informational/sales type piece taken with me. A suggestion as to how to best phase into proper cold storage/freezer space is expected back perhaps a general overview before I leave and a specific specification on another trip?

4. GYUMRI REFRIGERATED WAREHOUSE

Monday, November 18, 2002

City of Gyumri, the facility is state owned property (Ministry of Industrial & Economic Development).
Constructed in 1989-1990, after major earthquake
Stated capacity 10,000 tons of product
Constructed by "Intercool", a Denmark company
Refrigerant – R-717 (NH3) liquid feed system
Compressors – Sabroe (4-4 cy. & 2-8 cy. units)
Evap. cond. – B.A.C.
Construction – Pre-fabricated insulated panels,
Dock high building
Protection curbs, plastic strip doors
Racks used in some rooms, protection around racks.

Facility has 6 cold rooms, 1 consignment store, 2 process rooms and corridors.

The facility is in operational condition and considering that the facility is 12 years old it is in remarkably good condition and has been very well maintained. The refrigeration equipment is all modern technology equipment and the equipment installation methods are up to international standards.

The refrigeration system has good control and equipment protection systems in place and the temperature management systems are modern and in working condition. Electrical service panel has good phase guard protection in place.

The facility is being greatly under-used, but has great potential if some marketing program is put in place to increase the overall

usage. The facility appears to have a good technical staff to maintain the cold rooms and the facility in general.

5. REPUBLIC ASSOCIATION OF POTATO GROWERS

Monday, November 18, 2002

Located several kilometers outside of the town of Gyumri. The facility was constructed during the late soviet era using a combination of structural steel components and pre-fabricated insulated panels.

The refrigeration system runs on R-22 and the facility is being used for the long term storage of potatoes and sometimes other root crops, i.e. carrots, beets and even cabbage, etc.

The general layout is a central hall with various rooms to the left and right of the hall. The various rooms have several types of refrigeration and air movement systems in them. Some systems are original and some systems are only 1 year old (from Holland).

Potatoes are being stored in “slated bins” with some product being stored “bulk” style, 3 meters high, using “branch air ducts” under the “pile”.

The overall condition of the facility would rate as “poor to fair”. The overall maintenance of the floors, interior walls, air ducts, etc. could be much better. Painting of the walls, etc. is lacking scheduled maintenance.

The newly installed refrigeration equipment components were in good condition but we were not allowed to see the refrigeration units serving those units as they were “locked up”.

The manager requested literature or information on potato packaging materials, i.e. bags, plastic sacks, vent sacks, etc.

6. GAMMA

Tuesday, November 19, 2002

Gamma is located near the outskirts of Yerevan. Gamma originally started out as a manufacturer of metal cans for the

canning industry and in the past several years expanded into doing the actual canning operations themselves. They are presently canning cherries, blackberries, quince and several other products.

They have just finished a study and development of a new "branding" label and logo with the help of DAI for their canned products. In addition they have purchased some additional equipment for their can production line with the help of DAI.

Gamma is concerned about maintaining the quality of the product they are using in their canning operations and with that in mind they transport the fresh products they purchased from the farmers in closed transport trucks and for the most part, after dark when it is cooler.

Much of the product arrives at the Gamma facility and goes directly into the canning process. Some of the product needs to be held for 1 to 2 days before it is processed. I was told that volume of hold over could be up to 40 tons.

Gamma has identified two areas that they are planning to convert into cold storage rooms or areas for "hold-over" cold storage rooms. The first area that they want to convert has already been started and is planned as:

Phase I:

Proposed capacity – 40 tons^{M} (88,160 lbs.)
Proposed refrigerant – R-22
Electrical – 380V, 50 Hz.

Capacity study:

Assume pallet size 1^{M} x 1.2^{M}
Assume average weight = 1600#
Assume 8 rows of pallets across room
Assume 2 rows deep 2 x 8 = 16 pallets
Assume 1 row x 6 long or
other size of room = 6 pallets

22 pallets

Therefore 22 pallets at avg. wt. of 1600 lbs. equals 35,200 lbs., 40M tons = 88,160 lbs.
88,160 ÷ 35,200 lbs. = 2.5

Conclusion – To achieve the 40^{M} tons the pallets would have to be stacked three high over 2½ times the area of 22 pallet floor spaces.

Phase II:

Area 18M x 12^{M} x 4-4.5^{M} ceiling height

Client is looking for suggestions for sizing refrigeration system for both phase 1 and phase II.

7. APAVEN FREIGHT FORWARDING CO.

Wednesday, November 19, 2002

Apaven Freight Forwarding Co. is located in Yerevan.

We met with Mr. Gagik Azajanyan, Executive Director and discussed what their company does at this time and how they might participate in the future.

It became quite clear during our discussions that they are a traditional freight forwarding service company in every sense of the term.

At the present time they would play little or no part in connecting the links of the cold chain with the exception of full ocean container loads of product or perhaps railroad shipments of fresh vegetables or fruits.

8. BARIQ-P REFRIGERATION

Tuesday, November 19, 2002

Bariq-P Refrigeration is located in the village of J. Margava in the Armavir Marz region. The owner is Poghos Zakarian.

The facility was constructed in 1983 and is of concrete with tuff veneer, the structure is four stories high of which only the first

two floors are working. The owner claims that they store 2,000 tons per floor.

The facility is in varying states of disrepair, as examples the roof needs repairs as it leaks, the wall covering on the various floors need repairs, but not effecting its being used. The floors (concrete) are in need of repair and cause uneven travel by the forklifts and could cause loss of product by boxes falling from the pallet stacks.

The refrigeration equipment is all ammonia (R-717) of 1983 vintage, all but one of the compressors appeared to be working, that one had a motor off and in for repair. For its age the equipment appeared to be in fairly good condition.

This owner understands the advantages of pre-cooling the products quickly after harvesting to increase the quality and shelf life of the product, and in fact has had good success doing just that with fresh apricots being shipped to Russia.
(Send literature to owner).

9. CMN INTERNATIONAL S.A.
Wednesday, November 20, 2002

CMN International S.A. is located in Yerevan. We met with Irina Belubekyan who represents CMN in Yerevan and also serves on the Union of Armenian Manufacturers and Businessmen Assoc.

We discussed what services CMN International might be able to provide to the Agribusiness Industry in Armenia.

CMN International is a French owned transportation company and freight forwarding company. They offer a full range of freight forwarding services and are working with a number of major ocean shipping companies. They can provide both dry/non refrigerant and refrigerated ocean containers with door to door, port to port, door to port and other type services.

They also have connections with Russian and other trucking companies and can provide overland services to Russia and/or roll-on/roll-off services to a number of ports.

Ms. Belubekyan was quite knowledgeable in the matters of transportation in the region and beyond and should be a good source of information for future transportation matters.

10. MELTRANS

Wednesday, November 20, 2002

Meltrans is located in Yerevan. Our meeting was with the Director, Mr. Samuel Melikyan, who is also the President of Association of Armenian Freight Forwarders.

We discussed in general how the DAI program was helping to increase the Agribusiness exports and what role Meltrans may be able to play. Meltrans provides a full range of services and can provide trucks, refrigerated and non-refrigerated as well as ocean containers with full service down to door to port.

Mr. Melikyan told of service experiences they have had in the past with the transport of fresh apricots in which they had bad arrivals.

He is knowledgeable in the fact that pre-cooling and/or modified atmosphere may be needed in order to be successful. I left information with Armen Matosyan to share with Mr. Melikyan on the subject.

Meltrans, like CMN International, should be a source to keep in touch with for future transportation matters.

11. GEGHART SLAUGHTERHOUSE

Thursday, November 21, 2002

Geghart Slaughterhouse is located in Berd. This project is in the final stages of completion and involved the remodeling of an existing building into a modern animal slaughterhouse operation, with emphasis on cattle and swine. The Berd area is noted for the farming of cattle and swine but there is not a slaughterhouse in the region.

The new facility will be a full service facility which would purchase from local sources, slaughter at the facility, process the

by-products, chill the carcasses, store if needed, and transport by refrigerated truck to Yerevan or to the end destination.

The facility is approximately 70^{M} x 16^{M} and divided into offices for management, supervision, worker change rooms, rest room, lunch room, kitchen, holding rooms, wash (animal) room, slaughter room, by-products rooms, carcass chilling room, frozen carcass storage room, equipment room, etc.

The refrigeration equipment is used Soviet era equipment, but appears to be in good condition. I was told it has all been tested and operated. The installation of the equipment had all been installed in a professional manner.

12. USHI AGRO

Friday, November 22, 2002

Ushi Agro is located in the village Ushi outside of Yerevan.

This facility is utilizing a portion of a larger building to create two cold storage rooms that are connected by a common service corridor. The two cold rooms are 9' x 30' each with a sloped ceiling height of a average of 9'-6", the common corridor is 8'± wide x 30' long, with a ceiling height of 9'+.

The refrigeration compressors (R-12) are located in the corridor. The cold room uses a series of small surface wall coils, without circulation fans attached. They are attempting to achieve circulation by two small added fans in each room. They are getting a 2-3° spread between the floor temperature and the ceiling temperature, due to the lack of good air movement.

They are also having a lot of problems with the old Soviet type compressors, both with leaks and compressor failures. We discussed the use of more modern equipment and better air movement, etc., also the importance of humidity and temperature.

Literature will be sent back to share with them.

13. ZVARTNOTS INTERNATIONAL AIRPORT

Friday, November 22, 2002

Zvartnots International Airport's offices are located near the main terminal of the airport and about 1 to 2 kilometers from the cargo center facility.

The meeting was with Ana Cristina Schirinian, C.E.O. at her offices and also included Fred Harris, Armen Matosyan and myself.

The purpose of the meeting was to discuss our earlier meeting with Dr. Karen Mkhitarian (cargo manager) held on November 15th and to fill Ms. Schirinian in on the content of the cargo site meeting.

We discussed the concept of a proposed cold/freezer room concept that could be constructed within the existing facilities foot print, and discussed the construction concept that were shown on some preliminary sketches that were prepared specifically for this meeting.

It was agreed that the DAI consultants report would be shared with Ms. Schirinian and in addition, included in the report would be a preliminary budget for a cold/freezer room or rooms as depicted in the sketches along with some literature on pre-fabricated insulated building panels, refrigeration equipment and other related components.

All of this in an effort of providing the client with a basis on which to start their feasibility study for future needs.

Care was given in the preliminary design as to not disrupt their current daily operations or to interfere with any future additions onto the existing facilities.